

FY17 GRC: Testing Power Systems for Venus

Completed Technology Project (2017 - 2017)



Project Introduction

Earth's sister planet, Venus, is the most similar to Earth in size and the closest to Earth in location, but is one of the most hostile surface environments in the solar system. Nevertheless, Venus is a planet of great scientific interest. A number of advances in high temperature technology allow the possibility of designing a lander which can operate on the surface of Venus. The ability of the Glenn Extreme Environment Rig (GEER) to simulate Venus surface conditions, along with Glenn's expertise in high-temperature materials, electronics, and components, give Glenn unexcelled capabilities in developing and testing technologies for Venus. In this project, we aimed to test power supply components for Venus. However, all missions require power to operate, and a power system that can operate in the high temperature (450°C), high pressure (about 92 bar) corrosive environment has not yet been demonstrated. The goal addressed was to demonstrate the components for the power system for a Venus surface mission, an enabling technology for Venus exploration.

Anticipated Benefits

High temperature, high pressure power systems are a unique problem that is not being addressed by other programs. This addresses the first element of NASA's strategic goal: "Expand the frontiers of knowledge, capability, and opportunity in space." Power systems will be required for a future mission to the surface of Venus, supporting the NASA mission of solar system exploration. Glenn has a unique capability in this area, with expertise in power systems, high temperature materials and electronics, and capability to simulate the Venus environment. Benefits in 5 to 10 years are that we will prepare a demonstration of a power system that will allow a technology demonstration mission to the surface of Venus. Benefits in 10 to 20 years are that we will be able to build on this technology demonstration to open up the surface of Venus to as extensive an exploration program as we currently have on Mars, and will potentially be able to apply this technology to probes into the deep atmosphere of gas giant planets (which also have high temperature and pressure).



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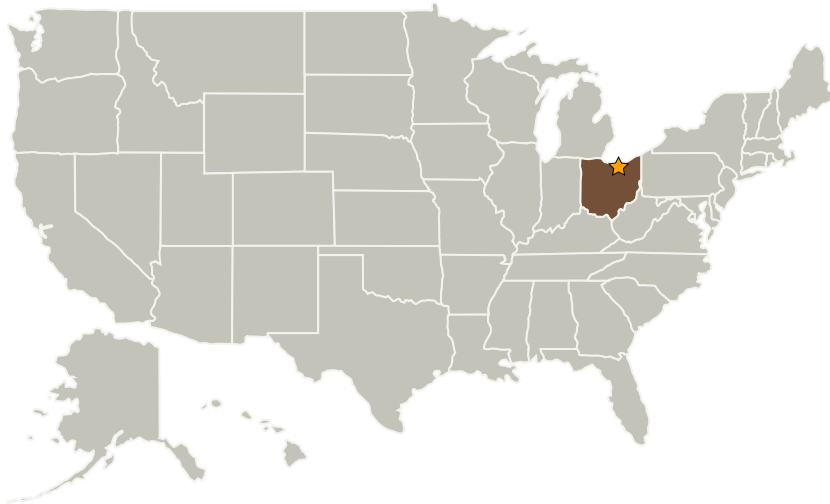
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Glenn Research Center (GRC)	Lead Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Ohio

Project Transitions

▶ **May 2017:** Project Start

✔ **November 2017:** Closed out

Closeout Summary: The development of high temperature technologies for planetary exploration will continue to be of interest. Future funding opportunities will be pursued to further mature and demonstrate this technology.

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Center Independent Research & Development: GRC IRAD

Project Management

Program Manager:

Gary A Horsham

Project Manager:

Geoffrey A Landis

Principal Investigator:

Geoffrey A Landis

Co-Investigators:

Matthew G Myers

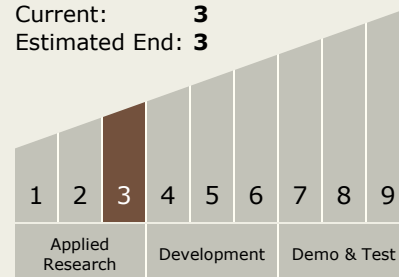
Lori A Arnett

Philip G Neudeck



Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
 - └ TX07.1 In-Situ Resource Utilization
 - └ TX07.1.2 Resource Acquisition, Isolation, and Preparation

Target Destination

Others Inside the Solar System

Supported Mission

Type

Planned Mission (Pull)